



**US Army Corps  
of Engineers.**



## **CITIZEN'S GUIDE TO THE** **2013 Comprehensive Evaluation**

**Protecting Salmon and Steelhead  
in the Columbia River Basin**

**FIVE YEARS OF PROGRESS UNDER THE FEDERAL COLUMBIA RIVER POWER SYSTEM BIOLOGICAL OPINION**



## The Columbia River Basin

Federal dams on the lower Columbia and Snake rivers helped shape the modern Northwest, fueling the economy with affordable electricity, reducing the risk of flood damage and irrigating crops to feed the nation. But they also affected the habitat of salmon and steelhead that migrate from the Columbia River Basin to the ocean and back. These fish had already been affected by more than a century of commercial fishing, mining and other human development.

In the 1990s NOAA Fisheries listed the first Northwest salmon and steelhead under the Endangered Species Act. Eventually, 13 stocks were listed as threatened or endangered.

Under the ESA, the U.S. Army Corps of Engineers, the Bureau of Reclamation, and the Bonneville Power Administration—collectively called the Action Agencies—must consult with NOAA Fisheries to avoid jeopardizing listed fish. NOAA Fisheries' Biological Opinion<sup>1</sup> guides operation of these dams, known as the Federal Columbia River Power System, to protect listed fish.

Today federal agencies are working with states, tribes and others across the region to protect those fish affected by the dams, which in turn continue to provide great value to the Northwest.

- Federal Dams
- Non-Federal Dams
- Canadian Dams

50 mi  
100 km

### Listed Fish Species

-  **Chinook Salmon**
  - Snake River Fall (threatened)
  - Snake River Spring/Summer (threatened)
  - Upper Columbia River Spring (endangered)
  - Lower Columbia River (threatened)
  - Upper Willamette River (threatened)
-  **Steelhead**
  - Snake River (threatened)
  - Middle Columbia River (threatened)
  - Upper Columbia River (threatened)
  - Lower Columbia River (threatened)
  - Upper Willamette River (threatened)
-  **Sockeye Salmon**
  - Snake River (endangered)
-  **Chum Salmon**
  - Columbia River (threatened)
-  **Coho Salmon**
  - Lower Columbia River (threatened)



# Progress to protect salmon and steelhead in the Columbia River Basin

This Citizen's Guide highlights five years of accomplishments described in the Comprehensive Evaluation—a progress report on the work by the U.S. Army Corps of Engineers, Bureau of Reclamation and Bonneville Power Administration to protect ESA-listed salmon and steelhead.

**T**hese agencies, collectively called the Action Agencies, work to offset the effects of federal dams on salmon and steelhead.

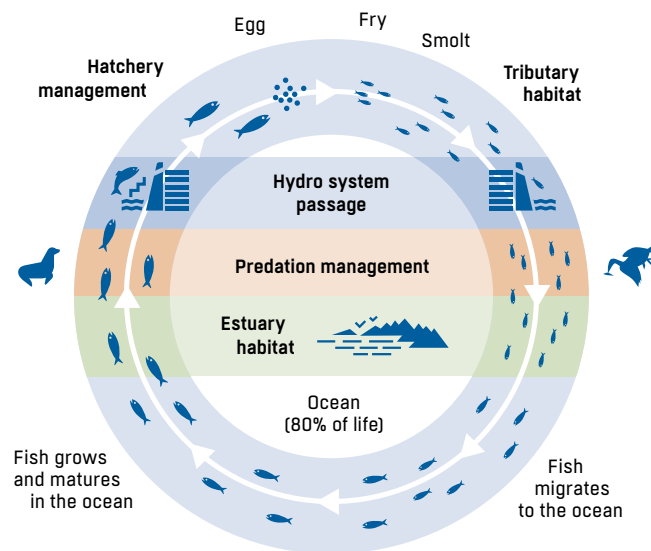
The effort has been enormous, involving hundreds of state and tribal partners throughout the region, biologists, engineers and hundreds of millions annually in funding from Northwest electric ratepayers and federal tax payers.

The Action Agencies and their partners have overhauled some of the nation's largest hydroelectric dams to make them safer for fish, rehabilitated long-degraded habitat across three states and managed predators to ensure that millions more young salmon and steelhead migrate safely to the ocean.

Importantly, since the time of listing, more wild fish have returned to their home streams to spawn and rebuild their numbers.

The bottom line is that BiOp implementation is working, as the following pages explain.

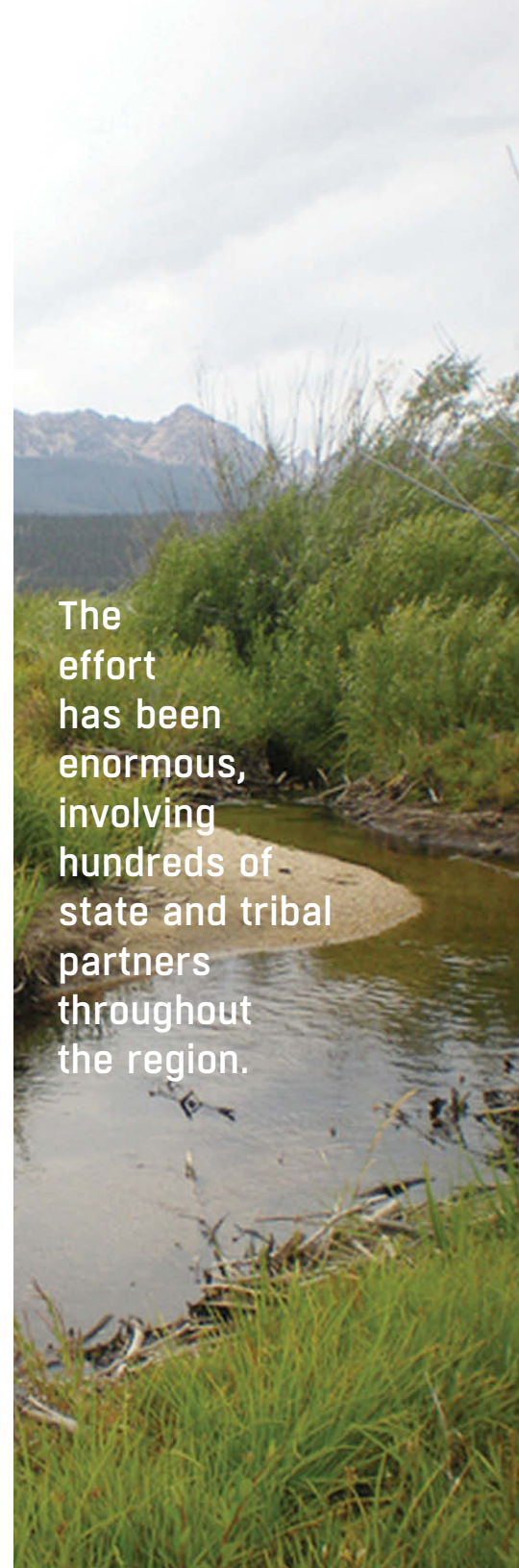
<sup>1</sup> NOAA adopted the 2014 Supplemental FCRPS BiOp in January 2014. For more background on the FCRPS BiOp, go to [www.salmonrecovery.gov](http://www.salmonrecovery.gov).



## Helping salmon and steelhead throughout their life cycle

Salmon and steelhead rely on many environments as they grow and mature, each with its own survival challenges. The Action Agencies take a comprehensive approach to address impacts, with hydro system passage, predation management, and improving habitat and hatcheries.

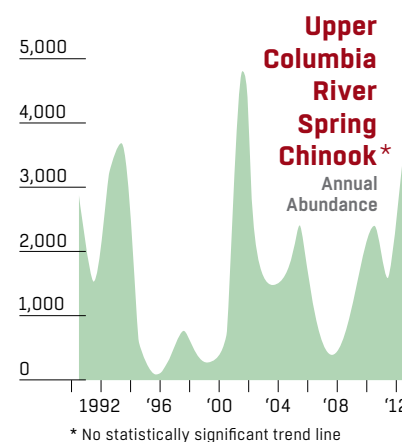
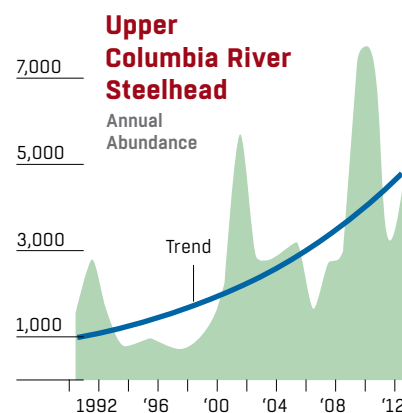
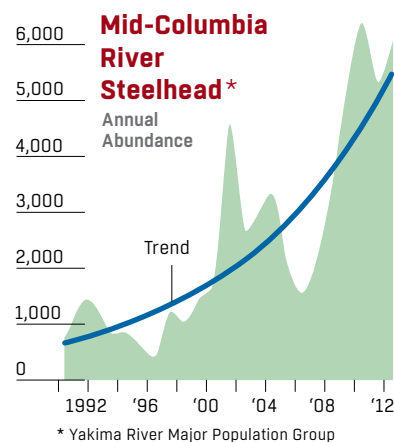
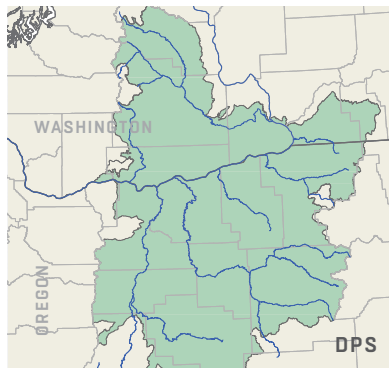
The effort has been enormous, involving hundreds of state and tribal partners throughout the region.





# Salmon and steelhead abundance is improving

An important measure of progress is that wild, or natural origin, salmon and steelhead are returning to spawn in Columbia River Basin streams and rivers. The Action Agencies have more than 50 projects underway to monitor the status of listed fish—by tracking their movements in streams, examining their genetics and surveying fish numbers and their habitat.



Scientists refer to abundance to indicate the number of adult fish born in the wild that return to a specific reach to spawn. The most complete data available on fish abundance are for the seven ESA-listed stocks that spawn in reaches above the FCRPS dams. These interior Columbia River Basin fish (shown below in the graphs) generally include one or more smaller populations unique to specific watersheds.<sup>2</sup>

Updated data show most populations that spawn in the interior Columbia River Basin have increased in abundance since the first ESA listings in the 1990s.<sup>3</sup>

## Abundance is an important indicator of fish health

Abundance and *productivity* (measured by the number of progeny that a spawning adult produces) are important indicators of fish health. NOAA Fisheries will use these indicators as well as geographic distribution and genetic diversity in assessing the status of the fish under the new FCRPS BiOp due in 2014.<sup>4</sup>

Natural annual variation in abundance and productivity can be substantial. Biologists consider trends to be more important than results in any single year. Recent research indicates that ocean conditions play a large role in the natural variation in salmon and steelhead populations. These variations are also influenced by other factors outside the hydro system, including tributary and estuary, predation and climate.

With the exception of Snake River sockeye, the charts here display only natural-origin fish. However, each of the listed species also includes a hatchery-origin component that contains and conserves some of the important genetic heritage of the species.





Aerial view of Snake River sockeye nests, known as redds, along the shoreline of Redfish Lake, high in Idaho's Sawtooth Range, 900 miles from the Pacific Ocean. Wild Snake River sockeye are again spawning naturally in the lake for the first time since the fish were listed in 1991.

SOCKEYE REDDS

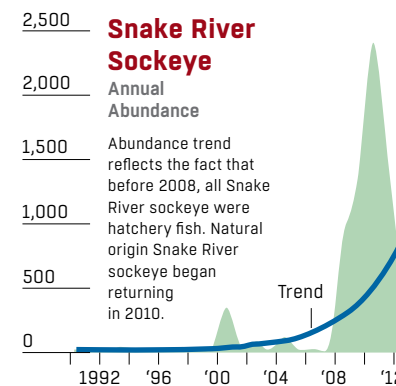
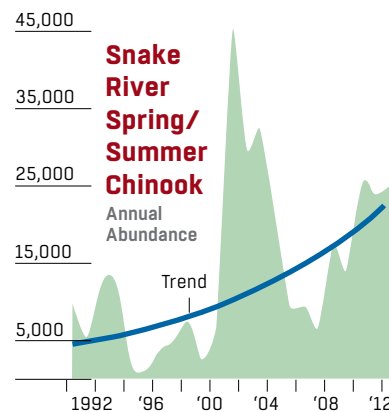
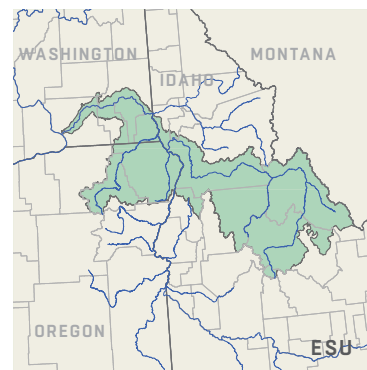
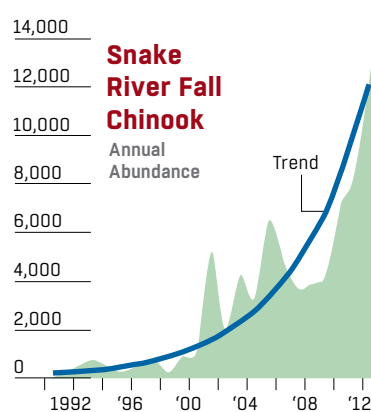
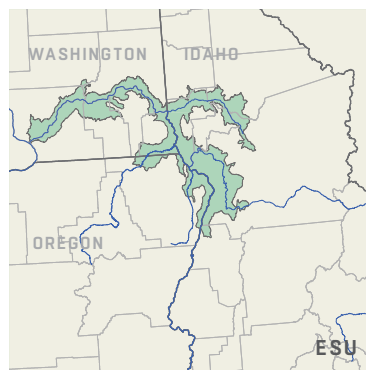
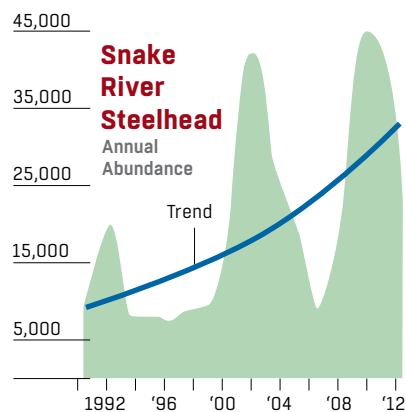
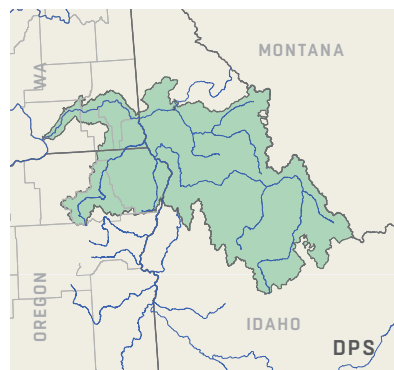
**Natural annual variation in abundance and productivity can be substantial. Biologists consider trends to be more important than results in any single year.**

▼ Shown is the number of natural origin adult fish returning to spawn. The abundance trend lines are calculated where the 1990 to present trend is statistically significant.

<sup>2</sup> There are a total of 78 populations within the seven Interior Columbia ESUs/DPSS. These abundance charts aggregate the population abundance at the ESU or DPS level.

<sup>3</sup> Abundance trend lines are calculated from 1990 until most recent available data. This is consistent with the "short term" trend estimation period that NOAA Fisheries uses in the BiOp to assess the status of the fish. Trend lines are shown where the 1990 to present trend is statistically significant. ( $p < 0.05$ ) (methodology from Good et al, 2005)

<sup>4</sup> For more information on the FCRPS BiOp, go to [www.salmonrecovery.gov](http://www.salmonrecovery.gov)





# Spill and structural improvements are increasing juvenile fish survival

Most salmon and steelhead in the Columbia River Basin encounter one or more hydropower dams as they migrate to and from the ocean. The Corps has made great strides in improving dam passage to enhance fish survival.

**A**ctions to improve survival of fish passing through the hydro system are an essential part of the FCRPS BiOp. Over the past decade, juvenile fish survival past the dams has increased due to extensive dam modifications and more effective and efficient spill operations using surface passage. Actions implemented at the federal dams include juvenile and adult dam passage

modifications, operational improvements for spill and transport, water management to improve waterflows and temperature and activities to improve juvenile and adult passage.

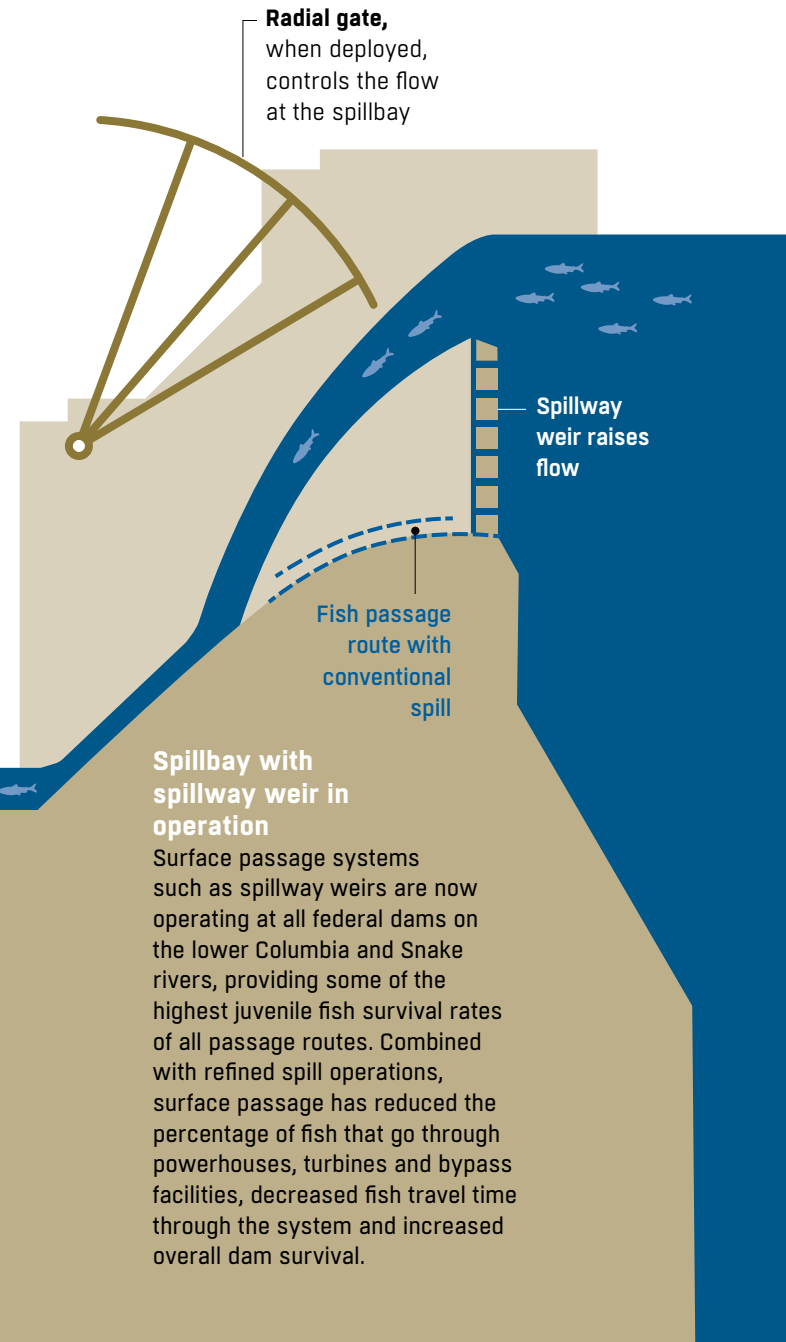
Some recent examples that have greatly improved juvenile survival include:

**The Corps improved bypass systems** by relocating outlets at Lower Monumental and McNary dams to sites less vulnerable to predators.

## **A spillwall installed at The Dalles Dam**

in 2010 significantly boosted survival in the tailrace by guiding fish to the main river channel, away from predators. Tests in 2010-2012 showed a marked improvement in survival of both yearling and subyearling Chinook over the pre-spillwall conditions.

Juvenile dam passage survival testing began in 2010. These scientifically designed tests estimate the Action Agencies' progress toward meeting BiOp



performance standards for juvenile salmon and steelhead survival past each dam.

The Corps developed and used state-of-the-art methods and tools for these tests, including a mark-recapture system. The innovative system resulted in the smallest acoustic tag available on the market to date and has the highest detection probabilities achieved to date for marked fish migrating through the FCRPS. The Corps worked with

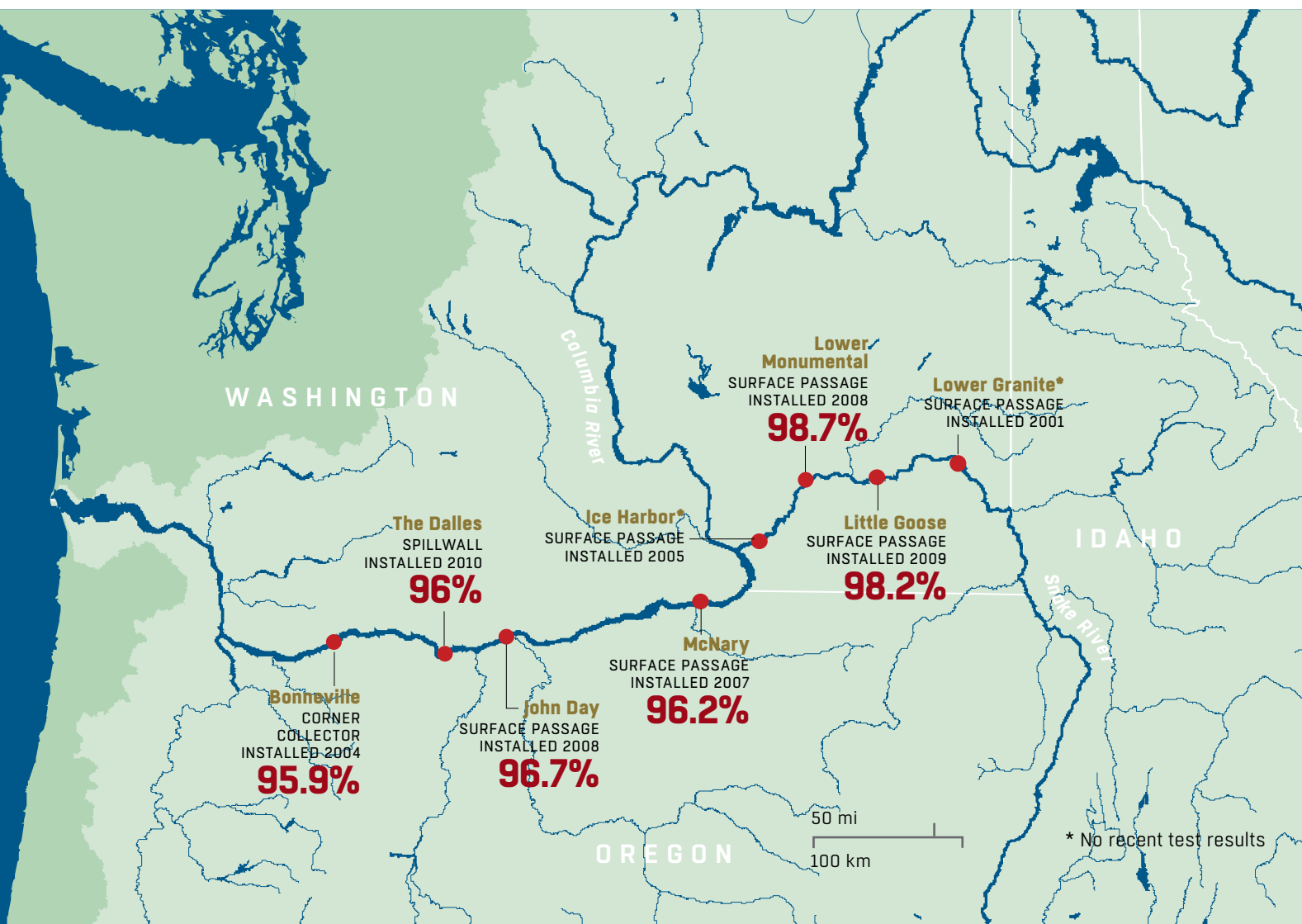
regional salmon managers and researchers to improve and standardize fish handling protocols, helping protect the fish and ensure that the best available science was applied.

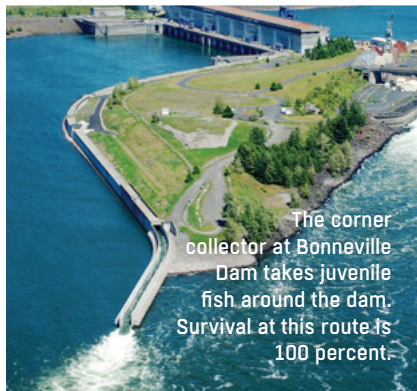
To date, performance testing indicates that all projects are on track to meet the BiOp performance standards of 96 percent survival for spring migrating fish and 93 percent survival for summer migrants.

**Surface passage systems allow fish to pass dams more quickly and safely at the surface, where they naturally migrate.**

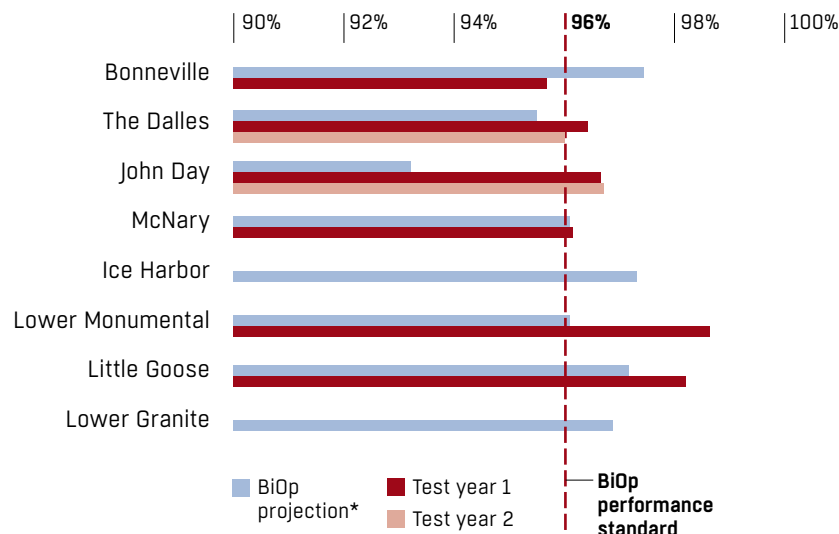
Shown are the dates surface passage was installed and 2010-2012 test results where available for juvenile spring Chinook overall dam passage survival.

Combined with refined spill operations, surface passage has reduced the percentage of fish that go through powerhouses, turbines and bypass facilities, decreased fish travel time through the system and increased overall dam survival.

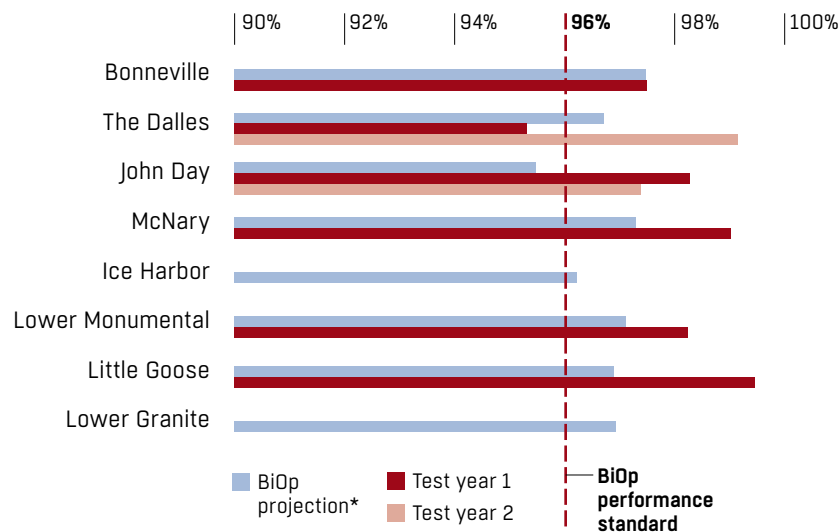




### Yearling Chinook dam passage survival

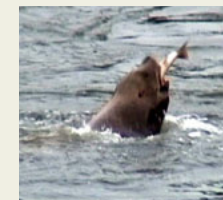


### Juvenile steelhead dam passage survival



▲ Scientifically designed tests in 2010, 2011 and 2012 estimated progress toward meeting the BiOp performance standards for juvenile dam passage survival. For a given dam to achieve the performance standards requires two years of testing with survival meeting or exceeding the performance standard each year.

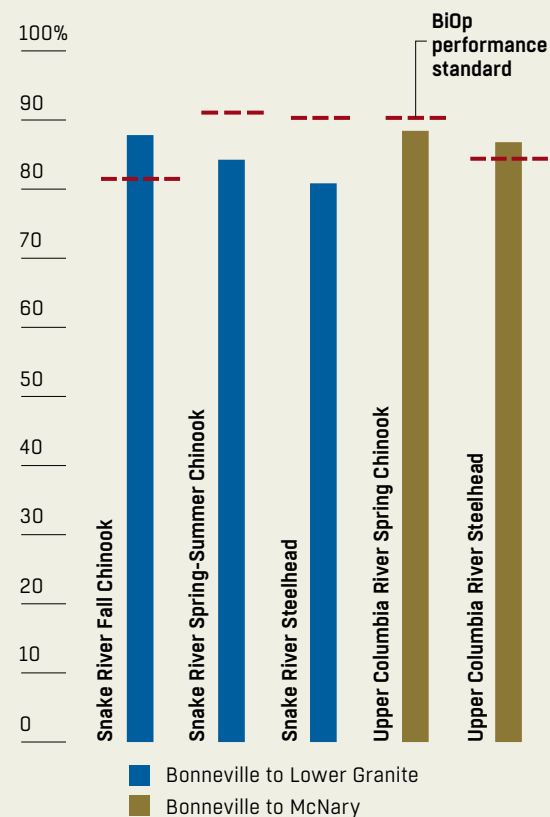
\*BiOp projection is NOAA Fisheries' projected estimated survival at each dam based on the structural and operations improvements specified in the BiOp.



Results in meeting the BiOp performance standards for adult fish survival were mixed. Sea lion predation, straying and harvest-related mortality all

affect adult fish survival estimates. High flows and high spill levels such as those seen in 2011 are also known to impede adult passage at the dams and increase losses to predation. The Action Agencies plan to track adult fish passage to better understand and quantify adult fish survival through specific dams and reaches and help identify solutions.

### Adult Chinook and steelhead five-year rolling average fish survival







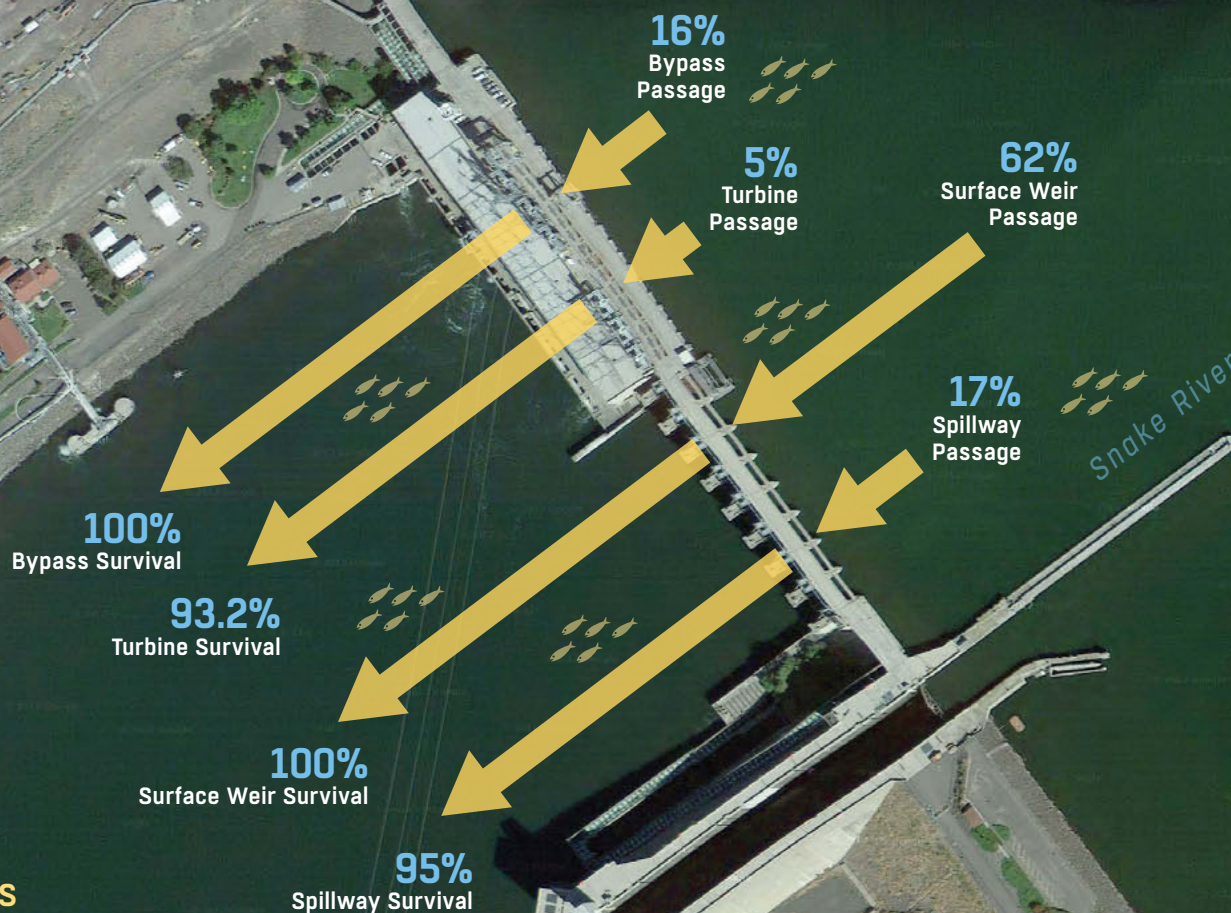
### Lower Monumental Dam Yearling Chinook 2012 Passage and Survival Estimates

# 98.7%

#### OVERALL DAM SURVIVAL

Juvenile fish pass dams by many routes: through turbines, juvenile bypass systems, spillways, or by collection and transport in barges or trucks downstream. Performance standard testing at Lower Monumental Dam in 2012 estimated overall survival for juvenile spring Chinook at 98.7 percent. The BiOp performance standard is 96 percent average per-dam survival for spring Chinook.

All projects are on track to meet the BiOp performance standards of 96 percent survival for spring migrating fish and 93 percent survival for summer migrants.





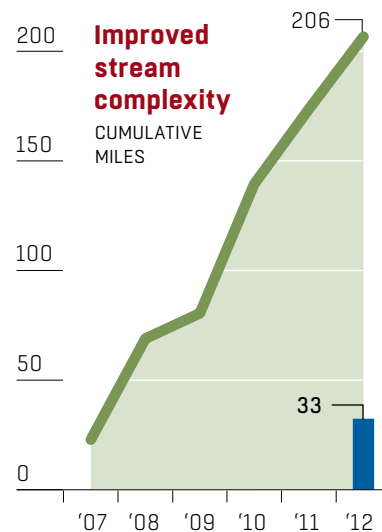


# Hundreds of tributary habitat improvements have been completed throughout the Basin

Halfway through the 10-year term of the BiOp, the Action Agencies and their partners have already met or exceeded the tributary habitat goals for more than half the salmon and steelhead populations the BiOp addresses. The Action Agencies worked with states, tribes, and watershed groups to identify actions to improve salmon and steelhead spawning and rearing habitat, targeting factors that limit fish survival. Project sponsors then completed hundreds of habitat improvements in the Columbia River Basin, with BPA ratepayer and federal funding and assistance, to address these priority limiting factors. This work has been done over a very broad landscape, including challenging areas with significant legacy impacts. The planning, relationships and infrastructure are well underway. The Action Agencies expect to meet the 2018 BiOp targets for tributary habitat improvements.

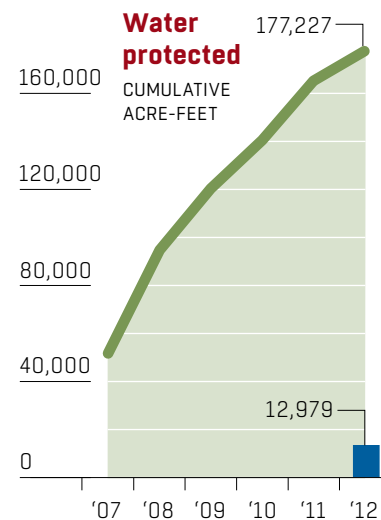
## Stream complexity creates more natural conditions for fish

Project sponsors have improved 6,812 acres of riparian habitat—an area larger than Portland's Forest Park, one of the nation's largest urban forests. They have improved 206 miles of streams by installing artificial logjams and enhancing side channels and meanders. Salmon and steelhead are spawning in greater numbers in the newly-improved reaches and increasing in abundance following treatment.



## Water restored to streams increases salmon and steelhead habitat

Through water transactions and irrigation improvements, the Action Agencies have secured 177,227 acre feet of water to Columbia River Basin streams, increasing flow to important salmon habitat. This is significantly more than the annual water usage of the entire city of Seattle. These flow improvements have been demonstrated to benefit fish survival by increasing available fish habitat.



### Tributary habitat projects benefit salmon and steelhead

The habitat program is among the largest and most comprehensive ESA programs in the nation. The BiOp identifies specific habitat quality improvement targets for 56 key populations of salmon and steelhead. Habitat projects are underway throughout the areas where ESA-listed fish covered by the BiOp originate.

- Key BiOp salmon and steelhead populations
- Listed fish areas
- Projects 2007-2012

PACIFIC OCEAN

50 mi  
100 km

CALIFORNIA

NEVADA

IDAHO

MONTANA

OREGON

WASHINGTON

CANADA

U.S.

CANADA

U.S.

Columbia River

Snake River

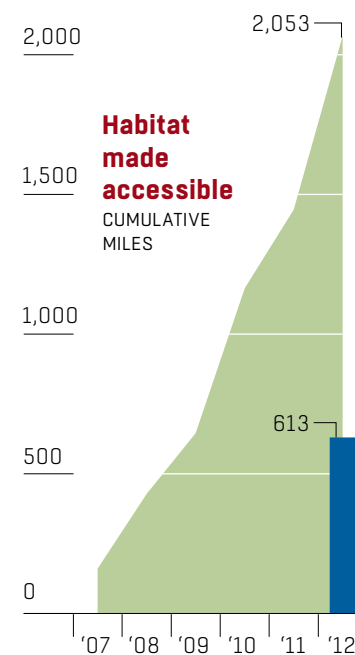
Koolen River

Clark Fork River

Snake River

### Habitat miles opened up—nearly twice the length of the Columbia River

Project sponsors opened 2,053 miles of important spawning and rearing habitat by eliminating culverts and water diversions. Science shows that improving fish access to these areas is one of the most effective habitat actions for salmon and steelhead. Project sponsors also installed or improved 247 water intake screens, preventing fish from being stranded or killed in water diversions.



2,000

2,053

1,500

1,000

500

0

'07 '08 '09 '10 '11 '12

613



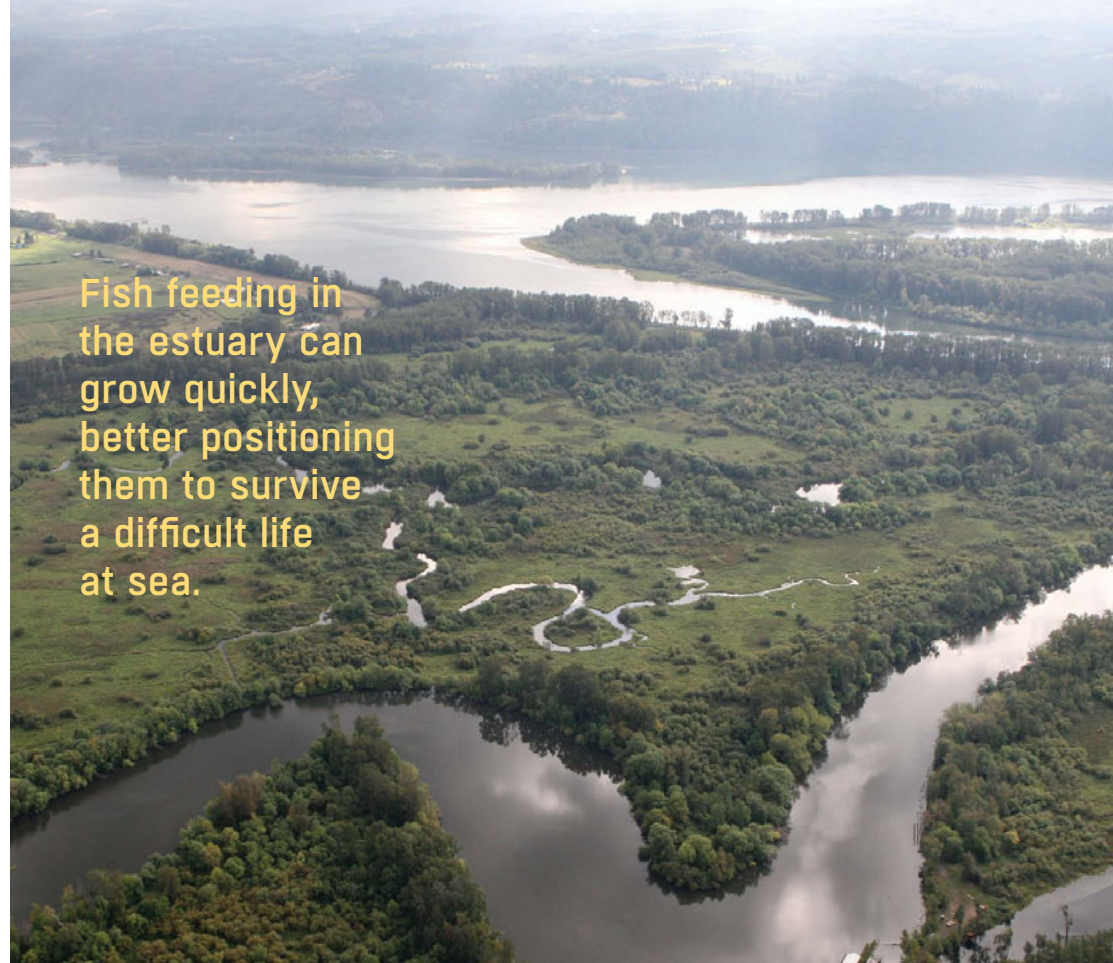
## Estuary habitat is key to fish survival

**T**he estuary's nutrient-rich habitat provides food and refuge for juvenile salmon as they make their critical transition from fresh water to salt water, where they grow at higher rates than they can in fresh water. Fish feeding in the estuary can grow quickly, better positioning them to survive a difficult life at sea. Sites several miles up tributaries have been shown to contribute to the estuary food web.

The estuary is a relatively recent focus in the Action Agencies' work to improve survival of salmon and steelhead. Emerging science is guiding key decisions.

Estuary projects can be complex, often involving a diversity of land owners and issues and requiring lengthy environmental and design reviews. While there have been challenges, the Action Agencies have reconnected areas to the Columbia River flood plain and restored juvenile habitat by opening dikes and/or upgrading tide gates or culverts.

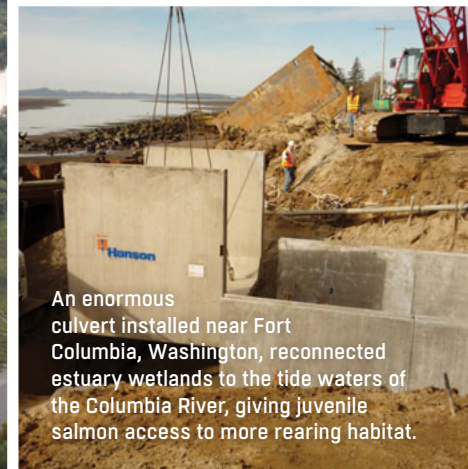
An extensive program of research, monitoring and evaluation has greatly improved understanding of the productivity and dynamics of estuary habitat and how salmon and steelhead survival depends on estuary wetlands.



**Fish feeding in the estuary can grow quickly, better positioning them to survive a difficult life at sea.**



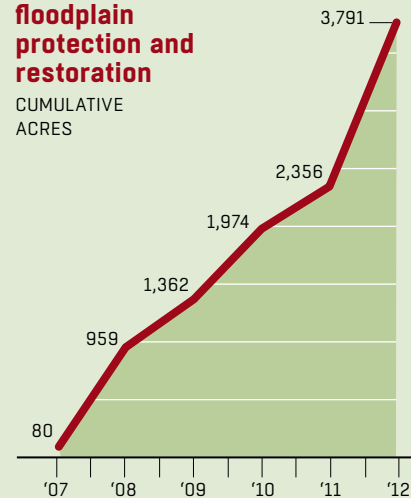
Large, contiguous properties such as the 920-acre Columbia Stock Ranch, acquired in 2012, bring many partners together for the benefit of fish.



An enormous culvert installed near Fort Columbia, Washington, reconnected estuary wetlands to the tide waters of the Columbia River, giving juvenile salmon access to more rearing habitat.

### Estuary floodplain protection and restoration

CUMULATIVE ACRES



### Lower Columbia River estuary projects 2007-2012



◀ The estuary habitat program is ramping up, with more projects planned for 2013-2018. The Action Agencies expect that pursuing a combination of high-value projects and one or more very large and complex projects will allow achievement of BiOp estuary performance targets by 2018.





# Hatchery reforms are protecting wild fish

Today, about 200 salmon and steelhead hatchery programs operate in the Columbia River Basin. Many are funded by the Action Agencies as mitigation for the FCRPS.

Increasingly, evidence has shown that hatcheries can help avoid extinction of at-risk populations.

Snake River sockeye, bolstered by a scientifically designed hatchery program, are returning in numbers not seen since the 1950s, with fish again spawning naturally in Idaho's Redfish Lake.

Hatchery evaluation and reforms help ensure that hatchery fish do not impede the recovery of naturally spawning fish. A key concern is productivity, the measure of a number of progeny that a spawning adult produces. The BiOp includes estimates of the benefits of hatchery reforms for many listed fish populations.

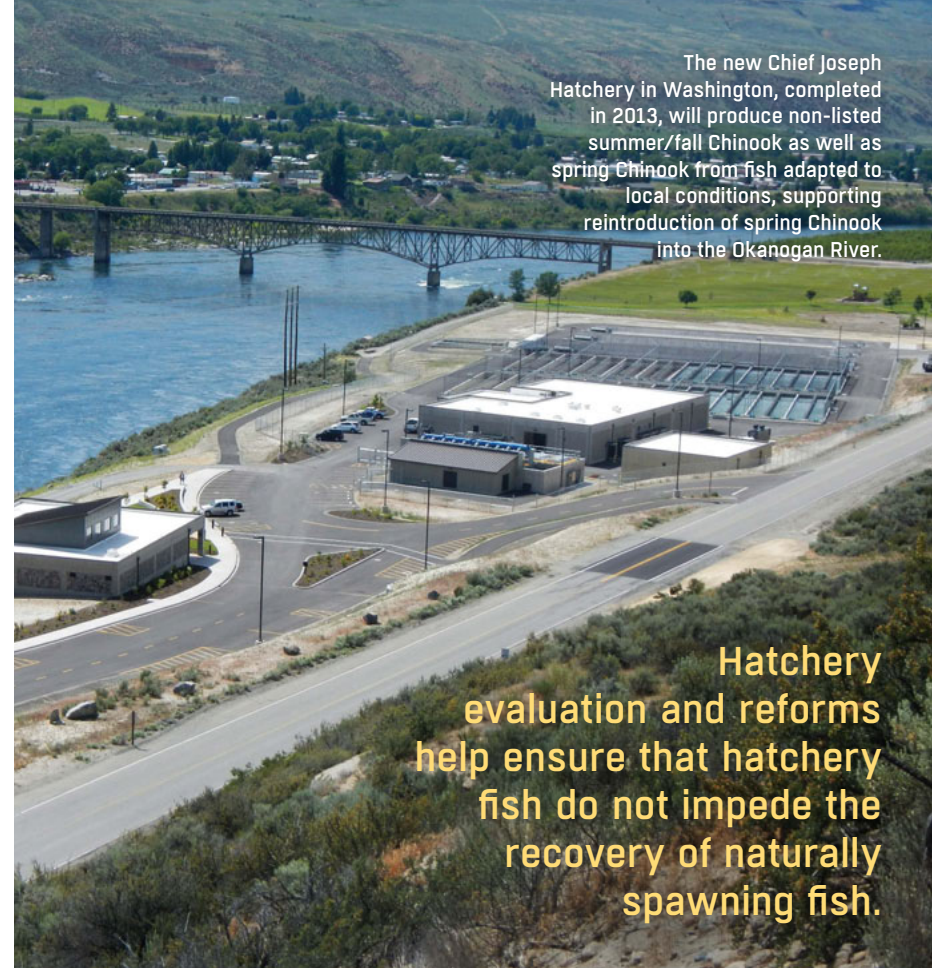
In 2012, the Action Agencies partnered with the hatchery operators to complete Hatchery and Genetic Management Plans (HGMPs) for all 44 of the Action Agency-funded hatchery programs requiring ESA consultation under the BiOp. HGMPs are the first step in NOAA Fisheries' review of these hatcheries as part of ESA consultation on each hatchery program.

The HGMPs call for practices such as improved broodstock management and methods to reduce unintentional straying of hatchery fish into known wild fish spawning and rearing areas. These practices are projected to provide an additional estimated productivity improvement for spring Chinook in the Methow and Imnaha rivers and steelhead populations in the Wenatchee, Entiat and Methow rivers.

Looking forward, the Action Agencies expect to meet hatchery reform goals specified in the BiOp by 2018.

**RIGHT:** Snake River sockeye hatchery staff gather returning sockeye for spawning in the hatchery. A new hatchery facility completed in 2013 will make it possible to increase juvenile sockeye production by up to one million each year and help rebuild the population to self-sustaining levels.

The new Chief Joseph Hatchery in Washington, completed in 2013, will produce non-listed summer/fall Chinook as well as spring Chinook from fish adapted to local conditions, supporting reintroduction of spring Chinook into the Okanogan River.



**Hatchery evaluation and reforms help ensure that hatchery fish do not impede the recovery of naturally spawning fish.**







# Cormorant predation is growing, while sea lion predation is down

The Action Agencies have made progress in reducing the number of juvenile salmon and steelhead consumed by predators.

**A sport reward program that pays a bounty on northern pikeminnow** 11 inches or larger has saved an estimated four to six million juvenile salmon every year since 1990.

**The number of adult salmon and steelhead consumed by sea lions** at Bonneville Dam in 2012 dropped to its lowest point in nearly a decade. The Action Agencies will continue to work with states and tribes to manage predation and will continue to monitor sea lion impacts and evaluate the need for and effect of control methods.

**Caspian tern consumption of juvenile salmon and steelhead** dropped from more than 6.6 million in 2008 to about 4.9 million in 2012 after the Corps took actions to attract the birds away from the estuary. These include building nine alternative nesting areas and reducing tern nesting grounds within the estuary.

**The Corps improved or replaced wires that deter seagulls from preying** on salmon and steelhead at The Dalles and John Day dams, reducing gull predation at the two projects from 124,000 fish in 2010 to 22,000 fish in 2011.

The Action Agencies are working with the U.S. Fish and Wildlife Service and NOAA Fisheries to develop a plan to manage Caspian tern predation in inland areas. This will help protect upper Columbia and lower Snake River juvenile salmon and steelhead as they migrate through the upper part of the Basin.

The population of double-crested cormorants in the estuary is expanding. These birds are protected by the Migratory Bird Treaty Act, and USFWS must authorize steps to control them. USFWS is revising its Depredation Order for cormorant control. At the same time, the Corps is working closely with USFWS on a management plan to control cormorant predation on East Sand Island in the estuary.

BROCKEN INAGLORY

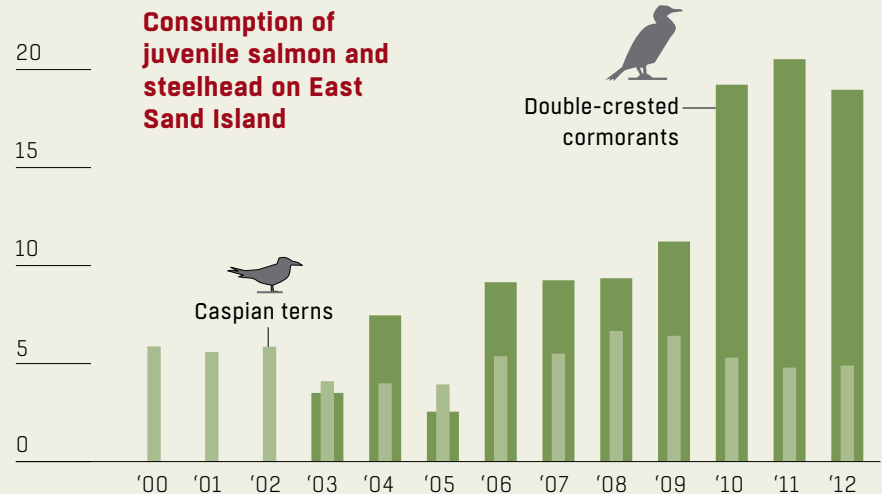


An estimated 13,000 nesting pairs of double-crested cormorants on East Sand Island consume more than 20 million juvenile salmon and steelhead annually. The Corps is working closely with the U.S. Fish and Wildlife Service and others to prepare an Environmental Impact Statement evaluating options for managing cormorants.



INGRID TAYLAR

25 million







## Taking steps for climate change

Experts project that climate change will affect tributary and estuary streamflow and water temperatures in the Columbia River Basin.

The Action Agencies recognize the importance of addressing the effects these changes will have on salmon and steelhead.

According to the Independent Scientific Advisory Board,<sup>5</sup> mitigating for climate change will involve many of the approaches already underway in the Basin. Water transactions and irrigation improvements add water to streams. Streamside habitat can be protected through

land purchases or conservation easements. Plantings or natural re-vegetation provide shade and other benefits for the stream. Because they can help keep water cool and clean, these projects are an important hedge against the longer term effects of climate change.

The Action Agencies also release cool water from Dworshak Dam and other upstream reservoirs, moderating temperatures in the river and providing better conditions for fish.

<sup>5</sup> The ISAB serves NOAA Fisheries, Columbia River Indian Tribes, and the Northwest Power and Conservation Council by providing independent scientific advice on issues related to those entities' fish and wildlife programs.

## Partnerships and science put us on track for BiOp goals

The Action Agencies are confident that we and our partners will achieve the FCRPS BiOp requirements by 2018.

The Comprehensive Evaluation has affirmed that hydro system improvements and operations are in place and working. Juvenile salmon dam passage survival rates are on track to meet hydro performance standards in the BiOp.

Throughout the region, hundreds of tributary and estuary habitat actions are already benefitting salmon and steelhead, and hundreds more are underway. Research is showing that salmon and steelhead quickly return to reopened habitat, spawn in greater numbers in restored reaches and increase in abundance following treatment.

Predator control actions are being developed and implemented and the BiOp requirements for hatchery reforms are on track.

Most important, the status of the fish is improving. Solid partnerships and sound science have put us well on the path to achieving BiOp requirements.

► **Salmon and steelhead are quickly returning to reopened habitat, spawning in greater numbers in restored reaches and increasing in abundance.**

**U.S. Army Corps of Engineers**

Northwestern Division  
Portland, Oregon

**Bonneville Power Administration**

Portland, Oregon

**Bureau of Reclamation**

Pacific Northwest Regional Office  
Boise, Idaho

For an electronic copy of  
this report or to learn more about  
the federal agencies' work to  
protect fish and wildlife, go to:

**Columbia Basin Federal Caucus**

<http://www.salmonrecovery.gov>

For more information on what our  
partners are doing throughout the  
Columbia Basin, go to:

**Pacific Coastal Salmon Recovery Fund:**

<http://www.nwr.noaa.gov>

**Columbia River Inter-Tribal Fish**

**Commission:** <http://www.critfc.org>

**Upper Columbia United Tribes**

<http://www.ucut.org>

**Northwest Power and Conservation**

**Council:** <http://www.nwcouncil.org>

**Oregon Watershed Enhancement Board**

<http://www.oregon.gov/OWEB/>

**Washington Salmon Recovery Office**

<http://www.rco.wa.gov/>

**Idaho Office of Species Conservation**

<http://www.species.idaho.gov>

**Thank you to:**

Our many state, local and tribal partners  
throughout the Columbia Basin.

**On the Cover:**

Center: Chinook in  
Northeast Oregon's Lostine  
River, photo by Mary  
Edwards Photography.  
Top left: riparian fencing  
in Idaho's Stanley Basin;  
center left: Columbia River  
estuary, photo by Tony  
Grover; bottom left: Reecer  
Creek near Ellensburg,  
Washington.



**SCAN & LEARN MORE**

FEBRUARY 2014.  
GRAPHIC DESIGN BY  
LUIS PRADO